Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Quadratic equations

Time allowed: 1 hour

Subject code **0580**

Mathematics

Questions from Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 47

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 47 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Solve by factorising.

$$3x^2 - 7x - 20 = 0$$

$x =$ ..... or $x =$ ..... [3]

Solving quadratics by factorising Click for more variations

1	$(3x + 5)(x - 4)$ [=0]	**M2**	**M1** for $(3x + b)(x + a)$ where $ab = -20$ or $3a + b = -7$
	4 and $-\frac{5}{3}$ oe	**A1**	If zero scored, **SC1** for 2 correct answers from no working or other methods

2 Find the values of x when $6x + y = 10$ and $y = x^2 - 3x + 10$.

$x =$ ..... or $x =$ ..... [3]

Simultaneous equations Click for more variations

2	0 and –3	**3**	**B2** for $x^2 + 3x$ [= 0] or better or **M1** for $10 - 6x = x^2 - 3x + 10$ oe or for correct simplification of *their* quadratic to the form $ax^2 + bx + c$ [= 0] or better or finding $y = 28$ and $y = 10$

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3 Solve the equation.

$$x^2 - 8x + 6 = 0$$

Show all your working and give your answers correct to 2 decimal places.

Answer $x =$ ..... or $x =$ ..... [4]

The quadratic formula Click for more variations

3	$x = 0.84$ or 7.16	4	**B1** $\frac{8 \pm k}{2}$ **B1** $\sqrt{(8^2 - 4 \times 1 \times 6)}$ or better **A1 A1**

4 Solve the equation $2x^2 + 3x - 6 = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer $x =$ ..... or $x =$ ..... [4]

The quadratic formula Click for more variations

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4	–2.64, 1.14 cao with working	**4**	**B1** for $\sqrt{3^2-4(2)(-6)}$ or better seen anywhere **B1** for $p=-3$ **and** $r=2\times 2$ or better as long as in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ After **B0B0, SC1** for –2.6 or –2.637(45…) and 1.1 or 1.137(45…)

5 **(a)** Write $x^2-18x-27$ in the form $(x+k)^2+h$.

..... [2]

(b) Use your answer to **part (a)** to solve the equation $x^2-18x-27=0$.

$x =$ ..... or $x =$ ..... [2]

(a) Completing the square (b) Solving by completing the square Click for more variations

5(a)	$(x-9)^2-108$	**2**	**B1** for $(x+h)^2-108$ or $(x-9)^2+h$ or $k=-9$
5(b)	19.4 or 19.39… -1.39 or -1.392…	**2**	**M1FT** $x-their9=\pm\sqrt{their108}$ **A1** for $9\pm\sqrt{108}$ or $9\pm 6\sqrt{3}$

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6 **(a)** Solve.

$$5x^2 = 12 - 17x$$

$x =$ ..... or $x =$ ..... [4]

(b) $ax^2 + a = b$ where a and b are integers.

One solution of this equation is $x = 6$.

Write down the other solution.

$x =$ ..... [1]

(a) Solving quadratics by factorising (b) Solving quadratics by factorising Click for more variations

6(a)	$\frac{3}{5}$ or 0.6 and –4	**4**	**M1** for $5x^2 + 17x - 12$ [= 0] **M2** for correct method to solve *their* $ax^2 + bx - c$ [= 0] e.g. factorising $(5x - 3)(x + 4)$ [= 0], completing the square or using the formula or **M1** for $(5x + a)(x + b)$ where $ab = -12$ or $5b + a = 17$ or correct partial factorisation e.g. $5x(x + 4) - 3(x + 4)$ or for $\sqrt{17^2 - 4(5)(-12)}$ or better or $\frac{-17 + \sqrt{d}}{2(5)}$ or $\frac{-17 - \sqrt{d}}{2(5)}$
6(b)	–6	**1**	

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7 Solve the simultaneous equations.
You must show all your working.

$$4y + 3x = 13$$
$$y = x^2 - 18$$

$x =$ ..... $y =$ .....

or $x =$ ..... $y =$ ..... [5]

Simultaneous equations Click for more variations

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7	$4x^2 + 3x - 85[= 0]$ or $16y^2 - 113y + 7[= 0]$ oe simplified	**M2**	**M1** for $4(x^2 - 18) + 3x = 13$ or $x^2 - 18 = \frac{13 - 3x}{4}$ or $y = \left(\frac{13 - 4y}{3}\right)^2 - 18$ oe or better
	correct method to solve *their* quadratic equation e.g. factors, quadratic formula, completing the square	**M1**	$\frac{-3 \pm \sqrt{3^2 - 4 \times 4 \times -85}}{2 \times 4}$ oe, $(4x - 17)(x + 5)$ $\frac{-(-113) \pm \sqrt{(-113)^2 - 4 \times 16 \times 7}}{2 \times 16}$ oe, $(16y - 1)(y - 7)$
	$x = -5$ $y = 7$ $x = \frac{17}{4}$ oe $y = \frac{1}{16}$ oe	**B2**	**B1** for one correct pair or two correct x values or two correct y values If B0 scored and at least 2 method marks scored, **SC1** for correct substitution of both of their x values or their y values into $4y + 3x = 13$ or $y = x^2 - 18$

8 Solve.

$$\frac{1}{x+1} + \frac{9}{x+9} = 1$$

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$x =$ ..... or $x =$ ..... [5]

Solving equations with algebraic fractions Click for more variations

8	$x = 3, x = -3$ nfww	**5**	**M2** for $x + 9 + 9(x + 1) = (x + 1)(x + 9)$ oe or better or **M1** for $x + 9 + 9(x + 1)$ or $(x + 1)(x + 9)$ oe or better **B1** for $x^2 + x + 9x + 9$ seen **M1 dep** for $[0 =]x^2 - 9$ oe simplified or better

9 Solve $\frac{4}{x+1} + \frac{2}{2x-5} = 3$.

You must show all your working.

$x =$ ..... or $x =$ ..... [7]

Solving equations with algebraic fractions Click for more variations

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9	[0 =] $6x^2 - 19x + 3$	**B5**	**B4** for $8x - 20 + 2x + 2 = 6x^2 + 6x - 15x - 15$ or better OR **M2** for $4(2x - 5) + 2(x + 1) = 3(x + 1)(2x - 5)$ oe or **M1** for $4(2x - 5) + 2(x + 1)$ or better or common denominator $(x + 1)(2x - 5)$ or better **B1** for $2x^2 + 2x - 5x - 5$ or better seen **M1** for correctly simplifying *their* quadratic to the form [0 =] $ax^2 + bx + c$
	Correct method to solve *their* three term quadratic	**M1**	e.g. $(6x - 1)(x - 3)$ $\frac{-(-19) \pm \sqrt{(-19)^2 - 4 \times 6 \times 3}}{2 \times 6}$
	$x = 3, x = \frac{1}{6}$ oe	**B1**	

10 Solve.

$$\frac{1}{x} - \frac{2}{x+1} = 3$$

Show all your working and give your answers correct to 2 decimal places.

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$x =$ ..... or $x =$ ..... [7]

Solving equations with algebraic fractions Click for more variations

10	$x + 1 - 2x = 3x(x + 1)$	**M2**	**M1** for a common denominator of $x(x + 1)$ seen or attempt to multiply through by denominators or for $\frac{x+1-2x}{x(x+1)} = 3$
	$3x^2 + 4x - 1[= 0]$ oe nfww	**A1**	
	$[x =]\frac{-4 \pm \sqrt{4^2 - 4 \times 3 \times (-1)}}{2 \times 3}$	**B2**	**B1FT** for $\sqrt{4^2 - 4 \times 3 \times (-1)}$ or better or for $\left(x + \frac{2}{3}\right)^2$ **B1FT** for $\frac{-4 + \sqrt{q}}{2 \times 3}$ or $\frac{-4 - \sqrt{q}}{2 \times 3}$ or for $-\frac{2}{3} \pm \sqrt{\frac{1}{3} + \left(\frac{2}{3}\right)^2}$
	–1.55 and 0.22 final answers	**B2**	**B1** for each or **B1** for –1.548 to –1.549 **and** 0.215… or for –1.55 **and** 0.22 seen in working or for –0.22 **and** 1.55 as final answer or for –1.5 or –1.54 **and** 0.2 or 0.21 as final answer

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